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The Coal Situation

Treatment of Industrial Wastes

"Loop" Highway

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JOURNAL OF THE

BOSTON SOCIETY OF CIVIL ENGINEERS

Volume XIII JANUARY, 1926 Number 1

THE COAL SITUATION

BY EUGENE C. HULTMAN,* MEMBER, BOSTON SOCIETY OF CIVIL ENGINEERS

(Presented at the Annual Dinner of the Affiliated Technical Societies of Boston, December 11, 1925)

IT is with great pleasure that I speak to you, my fellow engineers, upon coal, which seems to me to be the most vital and important commodity connected with the material welfare of New England. The United States Coal Commission succinctly set forth the real value of this great natural resource when it stated: "*Every man, woman and child is the beneficiary of coal.*"

New England's interest in coal is largely from the standpoint of consumers needing power and heat. At present New England has no developed sources of power outside of the limited water powers and wood, which is now hardly adequate to supply even our small rural population with household fuel.

The anthracite part of the coal industry has again "suspended" production; the mines have been idle since September 1. Therefore New England has a coal situation which is of the greatest importance to our householders, due to their self-imposed dependency upon anthracite.

When I was asked to prepare a paper for this meeting, on "The Coal Situation," no one could forecast what the coal situation would be at this particular time, but any one familiar with our household fuel troubles of the last several years could forecast that there would be a "coal situation." If the topic was assigned today the most interesting subject would probably be, "Who is Winning the Coal Strike?" The plan of action adopted by the New England Governors' Fuel Committee to meet the present coal situation is based upon education of the householders in regard to the selection and use of fuels, particularly *low vola-ile bituminous coal*, for home heating. This method has allowed the consumers to actively participate in the present controversy in the anthracite industry.

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* Chairman, Special Commission on the Necessaries of Life, Commonwealth of Massachusetts; Vice-Chairman, New England Governors' Fuel Committee.

I agreed to prepare a paper for this meeting, because it would give me an opportunity to present our household fuel situation to you, as I want to enlist the active support of the engineering profession in this campaign to reduce the cost of heating our homes.

New England's Fuel Bill

In 1924 New England used approximately 19,000,000 tons of bituminous coal, costing about $7.50 a ton, or a total of some $142,500,000. In the same year we used approximately 10,500,000 tons of anthracite, costing about $16.00 a ton, or a total of $168,000,000. In addition, it is estimated that our fuel and furnace oil bill was over $25,000,000. Thus the total bill in 1924 for New England's fuel for domestic and industrial purposes was some $335,500,000. Of this total bill about $138,000,000 was paid to producers, who, of course, are all located outside of New England; about $115,000,000 was paid to interstate carriers for bringing the fuel to this market; and the other $82,500,000 was spent on local transportation and distribution agencies.

The most significant thing to me is that the price we pay for heating our homes with anthracite is more than the price paid for about twice the amount of fuel used by all of our industries. Looking at the matter from the viewpoint of an engineer, the householder pays, on a heat unit basis, an even higher price for his heat than outlined above, because high-grade low volatile bituminous coal contains 20 per cent more heat units than domestic anthracite.

Already over one-half of the people in the United States use bituminous coal for heating their homes, and anthracite, if known at all, is regarded as a *luxury fuel*. Therefore if New England will burn bituminous coal we can save one-half of the money now paid for anthracite, thus having a vast sum of money to spend for more useful and satisfactory purposes than burning it up unnecessarily in our household heaters. If this plan is adopted, the people of New England will also be relieved of a source of great mental anxiety, which has probably caused more suffering here than the physical hardships resulting from an uncertain supply of domestic fuel. As an example of what some of our industrial competitors have done along this line, it is interesting to note that a few years ago the city of St. Louis was a regular customer for from 350,000 to 500,000 tons of anthracite per annum. Last year the total consumption in that city was about 40,000 tons. Why? Because the people have learned how to make use of perfectly good soft coal, which is costing them one-third the price they were paying for anthracite.

COMPARISON OF ANTHRACITE AND BITUMINOUS COAL INDUSTRIES

Many people think that conditions in regard to anthracite are typical of conditions in the entire coal industry. As chairman of the Special Commission on the Necessaries of Life, and Fuel Administrator at various times, I have endeavored to correct this erroneous impression on the part of the public. In considering the practicability of the plan to correct our intolerable household fuel situation by economic action, rather than by the slow and uncertain means of political action, which is the only other alternative, I believe a comparison of some of the conditions in the two branches of the coal industry is of interest.

In 1924 some 483,000,000 tons of bituminous coal were produced in the United States as compared with 90,000,000 tons of anthracite of which only about 70 per cent was available for domestic use, the balance being "steam sizes" that could not be sold advantageously in competition with bituminous coal.

The annual fluctuations in the production of bituminous coal, due to changing industrial demands, are greater than the entire production of anthracite.

Geologists estimate that the undeveloped reserves of bituminous coal will be sufficient to last thousands of years, while anthracite reserves are estimated to be sufficient for about one hundred and fifty years.

Bituminous coal has been found and is produced in some 28 States, whereas the production of anthracite is confined to an area of less than 500 square miles located entirely in Pennsylvania. There are thousands of separate owners of bituminous coal mines, and when prices go up the number of new mines and the production from existing mines increases at such a rapid rate that excessive prices cannot be maintained. In regard to anthracite, however, eight companies control nearly 75 per cent of the total production as well as controlling, directly or indirectly, about 90 per cent of the unmined reserves. Narrow and steeply pitching beds and other natural difficulties make the cost of mining anthracite much higher than the cost of mining bituminous coal.

Another factor which adds to the cost of anthracite is the fact that the "run-of-mine" coal does not make a good fire. This coal must be prepared; that is, sized, screened and the impurities removed. Those of you who have used anthracite in the past five years have probably thought at times that the "preparation of anthracite" was a lost art. Some of the bituminous coal producers also prepare their coal in sizes for domestic use, but in the case of low volatile bituminous coals it is not absolutely necessary to size it for domestic use. In fact, many householders have advised me that the " sized " coal burns too freely and some fine coal is needed to check the rate of combustion. Lumpy "run-of-mine" low volatile bituminous coal can be purchased by the New England householder in normal times for about one-half the price charged for domestic anthracite.

The labor situation also is different in the anthracite field from what it is in the bituminous coal fields. About two-thirds of the bituminous coal production is now from the so-called non-union districts, which are operating at a fairly regular rate on a lower wage scale than prevails in the so-called union districts. However, taking the bituminous industry as a whole, production is very irregular, and many mines in the union district have been idle for some time, due to loss of business to the non-union districts. On the other hand, the anthracite industry is commonly called a stabilized business; practically steady work is offered employees throughout the year; distribution is rationed with great efficiency among dealers; and good profits are enjoyed by capital. Most of those who have studied this industry believe it to be an artificial as well as a natural monopoly. The continual quarrels in this industry between capital and labor over the amount and division of the money collected from the consumer has at last stirred the New England householders from their usual apathy concerning anthracite. What we are trying to do is to help the public of New England help themselves by intelligently using their most effective weapon, — discrimination in making purchases, — and thus cause the Pennsylvania anthracite interests to awaken to the fact that the consumer has some rights besides that of paying the bills.

This year, until the stoppage of work in the anthracite fields, the condition of a large part of the bituminous coal industry might be well described as chaotic, and many concerns were on the verge of financial disaster. A part of the wages lost by the anthracite miners is being collected by the bituminous miners and operators. It is apparent that the union, as well as the non-union, miners and operators in the bituminous industry are benefiting by the anthracite suspension. Whether the anthracite operators will lose anything from this suspension of production is a question that will be determined by the extent to which the public will use other fuels. The question to be answered is, Will the people of New England turn to a highly competitive industry — bituminous — as a practical means of solving their household fuel problem, or will they continue to pay increasing prices for the privilege of using anthracite?

Governmental Action

Governmental action in regard to the mining of anthracite must be largely, if not solely, taken by the Commonwealth of Pennsylvania. In November, 1922, the United States Supreme Court upheld the contention of the Commonwealth of Pennsylvania that the mining and taxation of anthracite were entirely State matters. The New England States, together with New York and New Jersey, unsuccessfully contested the discrimination coal tax levied by Pennsylvania on our householders using anthracite. The higher the price the higher the tax collected by Pennsylvania, because the amount of the tax is based on the price of coal at the mine. It is apparently futile to expect Pennsylvania interests to repeal discriminatory taxes, guarantee good quality, insure a dependable supply, increase the production or lower the price of domestic-sized anthracite.

In 1922 it was necessary for us to complain to the Federal Trade Commission, because the company, which is the largest single producer and shipper of anthracite to New England, charged more for coal sold to our dealers than it charged for coal sold to western dealers. The Federal Trade Commission made a long and exhaustive study of this complaint. In their finding, after stating the evil of which we complained did exist, they stated among other things:

> The competitive conditions in the west of Buffalo territory will first be discussed. It is very clear that the consumption of high-grade bituminous coal, natural gas and coke west of Buffalo is increasing, whereas the consumption of the anthracite coal is decreasing. . . . Many economic and psychological reasons were advanced in explanation of this change. One of the most important elements to be considered is the difference in the spread between the prices of bituminous and anthracite west of Buffalo, as compared with the spread between such prices in Central New York and the East, where anthracite is holding its own. . . . Furthermore, persons with considerable knowledge of the business state that there is a decided prejudice east of Buffalo against the use of bituminous coal for domestic purposes, which prejudice is not particularly noticeable west of Buffalo. Whether this is caused by a mental inertia of the eastern householder or by his hereditary custom and usage, as compared with the greater adaptability of the middle westerner, is an open question. . . . This leaves the mental inertia, lack of adaptability, hereditary custom and usage, and the desire for personal and municipal cleanliness, as the only reasons for the well-known fact that householders in Central New York and New England will not use bituminous coal.

The Federal Trade Commission decided that it could give us no relief from this discrimination in price against our dealers.

Eventually, it will probably be necessary for the people of the United States to clear up the existing confusion concerning State and national rights in regard to coal by an amendment to the Constitution. At the present time our only hope of early relief is to help ourselves by using other fuels than anthracite for heating our homes, unless we wish to signify our willingness to pay a constantly increasing price for this fuel.

ACTION TAKEN TO MEET FUEL EMERGENCY

On August 20, 1925, when it became evident that another suspension of anthracite production would take place on the first of September, His Excellency Governor Alvan T. Fuller of Massachusetts called for united action by the New England States to throw off their anthracite bondage, pointing out that the price of this fuel had already increased over 125 per cent at the mine and 100 per cent at retail since 1913. The New England Governors' Fuel Committee was organized, of which Hon. John Hays Hammond, former chairman of the United States Coal Commission, is chairman, and I have the honor to be vice-chairman. This Committee has received the active support of all the leading industrial and commercial organizations in New England.

The Associated Industries, Chambers of Commerce and other civic organizations have taken up this work with great earnestness.

The first large organization of business men to take up the work of relieving our people of the continual worry and financial exploitation occasioned by their complete dependency upon domestic anthracite for household purposes was the Boston Chamber of Commerce, which appointed a Committee on Fuel Economy last spring. This Committee was actively engaged, even before the strike, in promoting the use of low volatile bituminous coal for household purposes. The work of the Boston Chamber of Commerce has undoubtedly had a great influence in interesting other civic and industrial bodies to join in this work.

The New England Governors' Fuel Committee made a careful study of anthracite, bituminous coals, coke, oil and other fuels, and that study, briefly summarized, showed:

ANTHRACITE

No more Pennsylvania anthracite would be available until some time after there was a resumption of production, except what was in householders' cellars and in dealers' yards, as well as a comparatively small amount in storage at the mines; that a limited quantity of foreign anthracite and semi-anthracite coals would be available. However, in past emergencies foreign fuels have been of uncertain quality and sold at very high prices.

Coke

Certain kinds of coke are good domestic fuel. The production of coke suitable for household use is limited and generally increases rapidly in price when domestic anthracite is scarce.

Fluid Fuels

Some of our householders who are willing and able to pay high prices for conveniences have been using oil for household heating. Gas is commonly used in some parts of the country for household heating, but its use has not been developed in New England to an extent which makes it of serious consideration in this emergency. Further, the use of fluid fuels entails considerable and expensive alterations in the heating apparatuses commonly used in our houses.

Wood

In rural districts wood is still the principal fuel for heating purposes; in the urban communities high cost prohibits its use for other than fireplaces and heaters in mild weather.

Bituminous Coals

There are hundreds of different kinds of bituminous coals, many of which are entirely unsuited for use in our household heaters. Careful study and investigation showed that the low volatile bituminous coals produced in the union and non-union fields of West Virginia, Maryland and Pennsylvania are good domestic fuels. The production is large and elastic; therefore their supply seemed ample and there is less likelihood of their prices being inordinately advanced if we adopted them as our principal source of relief during the anthracite suspension. These coals also seemed to us to offer the best probable solution of the permanent problem which we are trying to solve.

Therefore we arrived at the conclusion that low volatile bituminous coal was the most available low-cost fuel to supply the threatened deficit in household fuel caused by the anthracite suspension.

This Committee and other governmental agencies are strongly urging those who will need additional fuel during the winter to put in a full supply of low volatile bituminous coal at once, while transportation conditions are good and local distribution is not affected by severe winter weather. If this advice is followed, our householders will avoid acute conditions that will otherwise occur later in the winter.

To assist householders in selecting the proper kind of domestic fuel, as well as to inform them how to burn their fuel efficiently, a non-technical report was compiled by the New England Governors' Fuel

Committee. Already some 60,000 copies of this report have been distributed to interested parties. In addition, commercial and civic agencies and the coal trade have distributed circulars, set up demonstrating stations, and in many other ways are assisting the householders to use other fuels than domestic anthracite.

Since anthracite production stopped, the Interstate Commerce Commission established through freight rates on the "prepared sizes" of low volatile bituminous coal from the "smokeless" fields of West Virginia. These rates were made effective October 15, 1925. Considerable coal has already been received in this section, due to this action by the Interstate Commerce Commission, and it is expected that an increasing amount of coal will be available from this source during the balance of the winter.

The Smokeless Coal Operators' Association of West Virginia, who were allowed to come into this market by these rates, have established in Boston a Service Bureau for New England to show our householders the advantages of using their product. It is the intention of these operators to remain in this market permanently.

In addition, the Interstate Commerce Commission recently ordered temporary rates and routes to be established on or before December 31, 1925, and to remain in effect until April 30 next, on practically all of the West Virginia coals and some from Kentucky, as well as the semi-anthracite coal of Virginia. This action makes these coals available for competition with Pennsylvania coals in this market during the present household fuel emergency.

Low volatile bituminous coal in lumpy "run-of-mine" size is a good fuel for the domestic heater. This kind of fuel can be purchased today for from $2.50 to $3 a ton at the mine in Pennsylvania and Maryland, and brought to Boston for about $4 a ton. No through freight rates were established on the "run-of-mine" size from West Virginia. Screened sizes of low volatile bituminous coal may be purchased in limited quantities from both the West Virginia and Pennsylvania fields. The present price of this coal ranges from about $3.50 to $5.50 per net ton at the mine. The freight rate on the Pennsylvania coal to Boston is about $4, while the rate on the West Virginia coal is about $5.

Present Shortage of Anthracite in New England

Realizing that an accurate picture of our coal situation is necessary for public authorities to take intelligent action in the constantly recurring interferences with the production and distribution of coal, the Special

Commission on the Necessaries of Life has currently compiled a record of coal received in New England through tidewater ports and by rail. In Massachusetts we have also made periodical surveys of the receipts of domestic-sized anthracite as well as stocks on hand in dealers' yards. All of the dealers in the Commonwealth, numbering about 800, are included in these surveys. In this way it is possible to make the statement that some 726,000 net tons of domestic-sized anthracite were in dealers' yards on April 1, 1925, the beginning of the coal year, and since April 1 about 3,000,000 tons were received by our dealers, making a total of 3,726,000 net tons of anthracite available for our householders this winter. Most of this coal has been delivered to householders. During the last coal year (April 1, 1924, to March 31, 1925) dealers in Massachusetts delivered about 5,200,000 tons of anthracite. Therefore it is evident that Massachusetts has received already about two-thirds of its requirements of anthracite for this winter.

Massachusetts burns about 52 per cent of the total anthracite used in New England; Connecticut, 24 per cent; Rhode Island, 8 per cent; Maine, 7 per cent; New Hampshire, 5 per cent; and Vermont, 4 per cent. Therefore the total anthracite deficit in New England, if no more is mined this winter, will be about 3,000,000 tons.

Last spring the Commission on the Necessaries of Life began to urge consumers of both anthracite and bituminous coal to put in their supplies early, because trouble was anticipated in the fall, when the anthracite wage and working agreement expired. The Boston Chamber of Commerce broadcast over the radio the desirability of consumers getting their coal supply early this year. Consequently, more coal was bought last summer than usual.

Due to the recent loss of anthracite markets in the West and in Canada, if no suspension of mining had taken place on September 1, 1925, the anthracite mines would have been forced to shut down or go on part time this winter, because for the first time to my knowledge overproduction seemed imminent. Therefore, when the natural economic laws threatened to cause anthracite prices to weaken, a suspension of production occurred. The market has now been shortened and large quantities of the smaller and cheaper sizes of anthracite have been disposed of at high prices.

It seems as though New England is at last aroused, and that our people intend to use intelligently that resourcefulness, ability and determination for which they are noted and live up to their traditions by permanently disposing of the "anthracite bogey." This awakening of New England is known in Pennsylvania as shown by the statement recently made by the Governor of Pennsylvania to the anthracite operators and miners:

> The growing use of substitutes in thousands of homes and business enterprises, both within and without the State, seriously endangers the future of the anthracite industry and the well-being of the whole anthracite region.
>
> We are face to face not with one strike but with two. The second is a formidable strike of consumers against the uncertainty of supply and the constantly rising prices of anthracite. Neither the anthracite industry nor the Commonwealth of Pennsylvania, and especially northeastern Pennsylvania, can afford to leave this second strike out of account.

CONCLUSIONS

In the present coal situation there are only two courses open to us:

First. — We can plead for anthracite at any price. If we do so, anthracite production will probably begin shortly, and we will pay the cost of the present suspension of production. In the past several years the controversies which have arisen in the anthracite industry have been settled on such a basis.

Second. — We can declare our independence from the special taxation method employed by the Commonwealth of Pennsylvania and of the anthracite monopoly by using other fuels for our household needs this winter.

It is up to New England, New York and New Jersey to decide which method they prefer to follow in dealing with this coal situation. The New England Governors' Fuel Committee has recommended the adoption of the second method, which is in line with New England's traditions. So far the people of New England have shown not only that they desire to win this strike, but also that New England still possesses the ability, courage and resourcefulness of its forefathers to resist exploitation by outside interests.

Our coal situation has also directed public attention to the entire question of home heating. Scientific investigation shows that the average household use of fuel is grossly inefficient. The same service could be obtained with one-half the fuel. Bituminous coal, in its raw form or as a manufactured product, must be used in increasing quantities to heat our homes in the future, as is clearly shown by the fact that the production of anthracite has not increased with the growth of population. For instance, less anthracite was produced in 1924 than in 1911, although the population of the anthracite consuming territory increased about 20 per cent in that period.

It is said that doctors live on the sickness, lawyers on the quarrels, ministers on the sins, and engineers on the problems of the world. The engineering profession by its solution of the material problems of industry and commerce has made contributions of inestimable value to our social welfare and the progress of civilization. Engineers must now eliminate the great waste which exist in heating our homes. Whether the future household fuel will be a carbonized, briquetted or processed fuel, gas or electricity must also be determined by the engineers. As I look at the coal situation, there is a fortune to be made by whoever develops a convenient fuel based on low-cost bituminous coals, as the American people richly reward those who add to their ease and comfort of living. Therefore I cannot overemphasize the opportunity which I believe the awakened public interest in household heating offers to the engineering profession, not only for personal profit, but also as another chance to render a great public service.

HYDROGEN-ION CONTROL IN CHEMICAL TREATMENT OF TANNERY WASTES

By Stuart E. Coburn,* Member, Boston Society of Civil Engineers

(Presented before the Sanitary Section, Boston Society of Civil Engineers, on December 2, 1925)

At the beginning of this paper, it is well to explain briefly what is meant by the term "hydrogen-ion." When certain substances are dissolved in water, part of the substance remains in the molecular form and part is split into two components, one carrying a positive charge of electricity and the other carrying a negative charge. This is called "dissociation" and the electrolized particles are called "ions."

An example of dissociation is when sulphuric acid (H_2SO_4) is added to water, — part of the acid is dissociated into H-ions and SO_4-ions, the H-ions carrying the positive charge and the SO_4 ions carrying the negative charge. Water is also partly dissociated into the positively charged H-ions and the negatively charged OH-ions, but the H-ions present are very much fewer in number than in the case of dissociated sulphuric acid.

When we speak of the hydrogen-ion concentration of a liquid we mean the number, or, more correctly the weight in grams, of ionized hydrogen that is present in a liter of that liquid.

The very large fractions necessary to record the concentration of hydrogen make the numbers unwieldly, so we use the logarithms of the numbers. These, of course, are minus quantities, but if recorded as positive they become the familiar pH found in scientific literature today. In other words, the term pH may be defined as the logarithm of the reciprocal of the hydrogen-ion concentration in terms of the weight of ionized hydrogen in grams per liter. For example: When we say that pure water has a pH of 7.0 we mean that there are 0.0000001 grams of dissociated hydrogen per liter. Consequently, the larger the pH figure the smaller the H-ion concentration. In terms with which we are more familiar it may be stated that the greater the H-ion concentration the more acid the solution and *vice versa*.

---

* Chemist of Metcalf & Eddy, Consulting Engineers, Boston, Mass.

The explanation just given leads to an example of the economic value of pH measurement and control in the chemical precipitation of industrial wastes.

It has been found that sulphate of aluminum, or, as it is commonly known, "alum," is completely thrown out of solution as the flocculent precipitate of aluminum hydrate at a definite pH, and below or above this pH, part of the aluminum may be present in soluble form as sulphate of aluminum or as sodium aluminate, consequently the desired effect is lost. By controlling the pH we are able to get the full benefit of the alum.

Control of the hydrogen-ion of waters subject to purification has been used with varying success, but little work has been done on such control in the chemical treatment of sewage or industrial wastes. This paper, however, deals with a successful practical application of such control on the treatment of tannery wastes.

At the tannery and wool-scouring plant of the Winslow Brothers & Smith Company in Norwood, Massachusetts, the combined wastes are treated by plain sedimentation, chemical treatment with alum, intermittent sand filtration, and dilution before discharge into the waterway. There is a wide variation in the quality and quantity of these wastes within short periods of time, and with certain kinds of wastes it has been found practically impossible to obtain a satisfactory chemical effluent with alum; the filter beds became clogged, their capacity reduced and their efficiency lowered.

Because of the troubles encountered with the variation in the character of the settled wastes preliminary to alum treatment, it was believed that by maintaining the wastes at a definite pH it might be possible to produce an effluent from the chemical precipitation tanks that would be consistently satisfactory. Furthermore, it seemed reasonable to expect that if it were possible to dose the filter beds with a well-clarified effluent at all times, the periods between the cleaning of the beds would be increased, the number of beds thrown out of use would be decreased, and the volume of wastes that could be handled on a given area would, therefore, be increased. With these things in mind, laboratory tests were started to try out on a small scale the effect of adjustment of hydrogen-ion concentration upon precipitation.

The two methods in general use for determining pH are the so-called electrical or potentiometer and the colorimetric methods, both of which are fully described in Clark's "Determination of Hydrogen-Ions."

The electrical method requires delicate apparatus the use of which is somewhat beyond the ability of the average plant operator. The colorimetric method is much simpler, consisting in the addition of small amounts of various aqueous solutions of dyes or indicators. With different pH values different shades of color are produced with the dye so that it is necessary only to add the same amount of indicator to various standard solutions of known pH and then compare the color produced in the unknown solution with the color produced in the known.

In order to learn whether the colorimetric method gave correct results, the solutions were also checked by the potentiometer method and found to be accurate. These check tests also brought out the fact that it would be impracticable to use the potentiometer method to determine the pH of these tannery wastes, as after a single determination the platinum electrodes became "poisoned," that is, the electrode failed to function and it was necessary to go to considerable trouble to regenerate it.

As the colorimetric method was found to give correct results, laboratory experiments were then started on the tannery wastes, and a general outline of the method used throughout the experiments is as follows: "Catch" samples of the wastes were collected directly after passing through the sedimentation tanks and divided into portions of 200 c.c. each. To the control set, alum was added in varying known doses, the mixture stirred and allowed to settle for two hours. Observations as to turbidity and "settleable" solids were recorded. To another set, the hydrogen-ion concentration was increased by the addition of a known quantity of sulphuric acid, and then known quantities of alum were added and thoroughly mixed with the wastes. The mixture was then allowed to stand, and observations recorded as in the control set. To other sets the pH was varied to different degrees and alum added until the greatest clarification was obtained. In this way it was possible to determine the pH necessary for the most satisfactory results.

A summary of the results of the numerous tests is given in the following table:

TABLE 1.—SUMMARY OF EXPERIMENTAL DATA

	Alum Treatment	Alum and Acid Treatment
Chemicals used (pound per m. g.):		
Alum	8,400	4,300
Acid	–	2,801
Volume of sludge produced (per cent)	22.5	19.0
Color of top water *	Yellow 2 +	Yellow 2
Turbidity of top water *	3	3
Initial alkalinity †	668	286
Final alkalinity	204	113
Initial pH †	8.5	6.0
Final pH	6.1	5.4
Cost of chemicals (per m. g. wastes)	$142.80	$108.31
Saving by pH control (per m. g. wastes)	–	$34.49

* Numbers signify 1 = very slight, 2 = slight, 3 = distinct.

† Prior to treatment with alum, but after addition of acid with acid and alum.

The results of these tests indicated that by controlling the hydrogen-ion concentration of the wastes, it might be possible to reduce the cost of chemicals, to reduce the volume of sludge produced, and to increase the efficiency of treatment. The results obtained in the laboratory were so encouraging that it was decided to try out the method of pH control under conditions of actual plant operation.

Plant Operation. — To simplify the tests so that the plant operator could run them, it was necessary to make up permanent buffer standards colored with a proper single indicator for comparison. After some experimentation, it was found that by mixing two volumes of methyl red and one volume of brom-thymol blue there was no interference with each other's effective color range. This mixture has a pH range of 4.8 to 8.0, varying from red at pH of about 4.8, through orange at about 5.6, greenish yellow at about 6.2, to a bright green at pH 8.0. In the preparation of the indicator, it is necessary to dissolve the methyl red in 95 per cent alcohol, as otherwise the water used in the solution of the brom-thymol blue precipitates the methyl red. In order to prolong the permanence of the standards, the addition of a small amount of formaldehyde was found to be helpful.

In making the test at the treatment plant about 5 c.c. of the wastes were diluted with an equal amount of distilled water, 1 c.c. of the indicator added, and the color obtained matched against the standards by the use of a comparator. To avoid the use of decimals, which might confuse the plant operator, the standards were given numbers corresponding to ten times their pH value. If the operator found by his test that the wastes were "over 60" he added acid until this point was reached, and then enough alum was added to produce a good appearing "floc." If the test showed the wastes to be "under 58" he would add milk of lime to increase the pH until this point was reached before the alum was added. In other words, he would regulate the pH of the wastes to a range 5.8 to 6.0 before the addition of the sulphate of alumina.

The results obtained under working conditions have been so satisfactory that it is now a part of the routine plant operation to regulate the pH of the wastes prior to coagulation with alum.

The entire chemical control, such as making up the alum solution, filling the acid tank, making the milk of lime, pH tests and the regulation of the flow of solutions, is handled by one man.

The results of three years' operation with hydrogen-ion control are compared with nine years' operation without this control in the following table:

TABLE 2.—COMPARISON OF CERTAIN OPERATION RESULTS AND COSTS WITH AND WITHOUT pH CONTROL

ITEM	Average, 1914–22	Average, 1923–25	Reduction (Per Cent)
pH control	No	Yes	–
Liquid sludge produced (gallons per m. g. wastes)	35,820	21,090	41
Dry solids in sludge produced (tons per m. g. wastes)	4.04	3.08	24
Chemicals used (pounds per m. g. wastes):			
Alum	5,790	2,615	52
Lime	334	145	59
Acid	–	2,803	–
Cost of chemicals (per m. g. wastes)*	$101.00	$70.41	30
Filter-bed operation (rate per acre per day, gallons)	50,000	72,500	45 (increase)
Cost of filter operation (per m. g.)	$65.29	$50.00	23

* Based on alum at 1.7 cents per pound, acid 0.9 cents per pound, and lime at 0.5 cents per pound.

In addition to the very favorable results obtained with pH control, as shown in the table, there is another point which should be emphasized. In former years it was impossible to treat certain wastes successfully with alum and obtain a well-clarified effluent, whereas with the hydrogen-ion control in use it has been always possible to obtain a well-clarified effluent after chemical treatment. Furthermore, the filter-bed effluent has been better, due, probably, to the maintaining of constantly suitable conditions for optimum bacterial action in so far as reaction of the wastes was concerned.

In conclusion, the benefits derived by controlling the hydrogen-ion concentration of tannery wastes subjected to chemical precipitation as compared with treatment without such control may be summarized as follows:

1. A well-clarified effluent can be produced at all times.
2. The cost of chemicals is very much less.
3. The amount of wet sludge produced is considerably less, consequently the sludge bed area required is less.
4. A much larger volume of wastes can be applied to the filter beds without the final effluent deteriorating in quality.
5. A material reduction in the clogging of sand on the filter beds occurs with a corresponding decrease in frequency of cleaning.
6. Finally, and most important from the standpoint of the manufacturer, all these benefits result in a very material saving in the cost of treatment.

A PLANT FOR THE DEGREASING OF WOOL-SCOURING WASTES

By George G. Bogren,* Junior Member, Boston Society of Civil Engineers

(Presented before the Sanitary Section, Boston Society of Civil Engineers, on December 2, 1925)

The wastes-treatment plant, described in the following article, was built in 1909 after complaints had been made to the Massachusetts Board of Health that the wastes discharged from a certain worsted mill in Hudson, Mass., were rendering the waters of the Assabet River unfit for use in textile mills, further down the stream.

The wastes in question were those resulting from the scouring of wool. Wool, before being subjected to any of the processes of the textile industry, is scoured or washed to remove three undesirable constituents, — "wool grease," which is more like a wax than a true grease, and is unsoluble; "the suint," or soluble salts of fatty acids which are contained in the perspiration of the animal; and miscellaneous dirt which is entangled in the wool fiber. The raw wool is washed in a solution of soap and strong alkali to remove these undesirable constituents, which make up from 25 to 75 per cent of the weight of the raw wool, depending on its source.

The resulting washing or scouring liquor is an emulsion of fats in water; it is decidedly disagreeable in appearance and odor, and ferments readily.

Original Plant

The plant which was constructed in 1909 to treat this waste to render its discharge into the Assabet River possible without causing obnoxious conditions was of the so-called "acid-cracking" type, supplemented by filtration. The wastes, highly alkaline, were treated with sulphuric acid in large tanks. The acidifying of the waste caused a breaking up of the emulsion, and separated the grease from the water. The "cracked" grease settled to the bottom of the tanks, due to the presence of so much foreign suspended matter, thence it was drawn off and discharged upon sludge beds, composed of a thin layer of sand, covered with a thin layer of sawdust, for drying. After drying, the sludge was placed in filter presses, where the grease was removed under heat and high pressure.

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* Sanitary Engineer of Weston & Sampson, Consulting Engineers, Boston, Mass.

The acid-treated waste from the tanks in which the acid was applied was passed through a subsiding basin where more suspended matter was removed, and thence to filter beds, composed of a layer of sand covered by a thin layer of sawdust. The effluent from these filters was of good appearance, although its high acidity rendered it undesirable in the stream, due to its action on fish life. The filter beds clogged quickly, from the very nature of the waste, and the labor required to keep these beds in condition and to operate the filter presses was so great that the plant was economically impracticable, though satisfactory from a sanitary engineering standpoint.

Present Method of Operation

A more economical method of treatment was sought, and after exhaustive experiments with many types of treatment, the plant was reconstructed along its present lines in 1919. The present plant depends for the separation of grease upon treatment in centrifugal separators, similar to those used in dairies for separating milk and cream.

At the present time the normal amount of wool-scouring waste treated by the plant is about 25,000 gallons daily, while the grease content of this waste ranges from 0.1 to 3.0 per cent, depending on the source of the wool being scoured, and averages less than 1 per cent. The waste flows from the mill to a collecting well, thence it passes through a heating device to subsiding tanks.

The heating device is a so-called "instantaneous heater," and consists of a tank in which the waste passes through many small tubes surrounded by live steam, the waste and steam flowing in opposite directions. The steam used is bled from a turbine at low pressure, thereby furnishing a cheap source of heat. Formerly the waste was run into the tanks, after which it was heated by steam coils, but the present device is considered superior.

Subsiding Basins. — After being heated to 70° C., the waste is discharged into subsiding basins, which are four in number, totaling 29,000 gallons capacity. These are concrete tanks of rectangular shape with pyramid hopper-bottoms. They are operated on the draw and fill principle. During the period of detention in these tanks, the emulsion of fats is somewhat broken up, causing some fat to rise to the surface. The suspended dirt in the waste settles to the bottom of the tanks. The purpose of heating the waste prior to subsidence is to prevent fermentation of the waste in the tanks and to aid in separating the grease.

Centrifuge. — An alternative for the subsiding basins is also provided. This is a large centrifuge in which the suspended matter is removed from the hot waste by centrifugal action. A cylindrical bowl revolves at a high rate of speed, and the heavy suspended matter which in the settling tanks would sink to the bottom, here impinges on the outer walls of the revolving cylinder. Although it is more efficient in removing suspended solids than the tanks, the difficulty of cleaning it makes it less favorable with the operators, and the subsiding basins are in use at the present time.

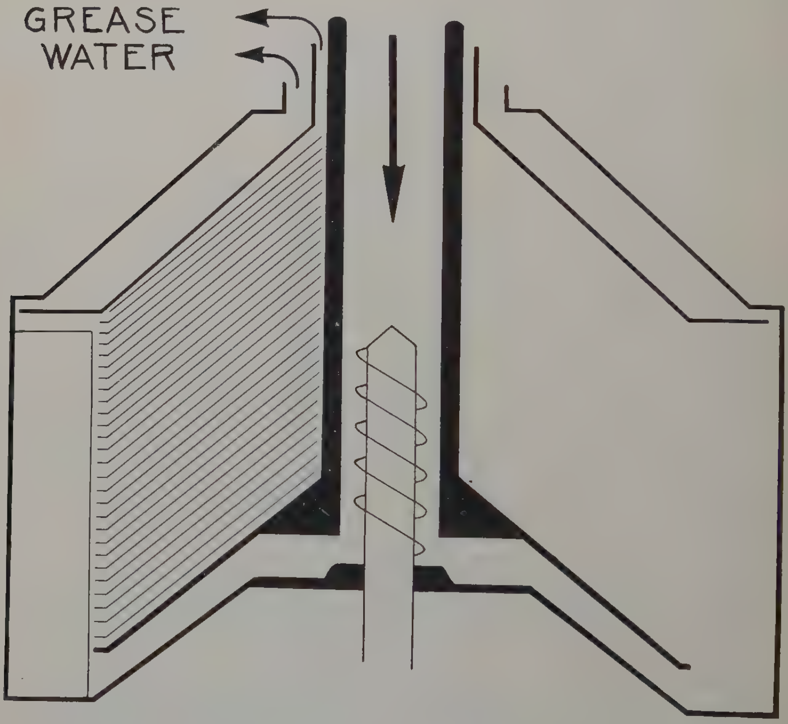

Fig. 1. — Diagrammatic Cross Section of Centrifuge

The sludge which settles to the bottom of these subsiding basins is discharged into a collecting well, thence it is pumped to elevated storage tanks. It is carted away at frequent intervals by farmers, to be used as a fertilizer. The average amount of sludge removed from the normal daily flow of waste is 7,500 to 10,000 pounds (wet). This sludge contains from 2 to 3 per cent of fats.

Separators. — The waste is drawn from the subsiding tanks through a floating outlet, so that the surface liquor is constantly removed. This waste then passes to the separators, six of which are of 750 gallons per hour capacity, and one of which is of 1,500 gallons per hour capacity. These machines consist of a bowl revolving at 6,000 revolutions per minute, into the center of which the waste is discharged (Fig. 1). The bowl is divided vertically into many narrow compartments by a series of nested conical shells. These have an angle of slope of approximately 30° from the vertical. The entire bowl and its contents revolve, tending to force the heavier constituents to the periphery of the bowl, by centripedal force. The heavier constituents in this case are water and any suspended matter. The suspended matter impinges upon the outer shell of the bowl, while the water tends to force the grease toward the center of the bowl, due to the relative differences in centripedal force of the two liquids, the water being the heavier. The relative differences in specific gravity of water and grease cause the grease to rise toward the top of the bowl, and the conical deflecting shells conduct the grease toward the center of the bowl, to an outlet, while the water is drawn off on the outer edge of the bowl. When the separator becomes clogged with suspended matter, it must be taken apart and cleaned. The period of operation between required cleanings obviously depends on the efficiency of the subsiding basins in removing the suspended matter, and averages 3.5 hours.

These separators remove approximately 50 per cent of the grease, although under unfavorable conditions the yield will drop to as low as one-half this amount. The " degreased " or treated waste is discharged from the separators directly into the Assabet River.

The grease removed from the waste by the separators is of high quality. Being neutral, it is of higher value than the acid-cracked grease. The quantity of neutral wool grease removed daily is from 250 to 350 pounds, or about ½ ounce for every gallon treated. It contains about 1 per cent ash; ⅓ per cent free fatty acid; and from 0.5 to 7 per cent water, averaging 2 per cent. It consists principally of solid alcohols plus the potassium salts of the fatty acids. It is used mainly in the manufacture of lanolin, which is the base of many salves and cosmetics. Lanolin is neutral wool grease which has been repeatedly washed to remove soluble impurities. It contains about 25 per cent water. The selling price of neutral wool grease increased from 2½ cents per pound in 1915 to 9½ cents per pound in 1923, an increase of nearly 300 per cent. The present selling price is in the neighborhood of 6 cents per pound.

Comparison of Methods

It is interesting to compare the acid-cracking type of plant as originally constructed with the present plant, employing centrifugal separators. As far as operating expense is concerned, the latter is more economical. A great saving is made through the small amount of labor required in the present plant. The present plant requires only two men to operate the separators, which are the only units requiring constant attendance. The acid-cracking plant employed about nine men to remove the sludge from the drying beds, place it in bags for the filter presses, and operate the presses. The present plant requires no chemicals, while the acid-cracking plant used about 1,200 pounds of sulphuric acid daily, or about .05 pounds for every gallon of waste treated. This amount of acid would cost about $8.50 today. The present plant uses electric motors to drive all the machines, with the exception of the pumps which pump the sludge from the collecting well to the storage tanks and the pump which lifts the grease to a storage tank. These pumps operate for but a short period at infrequent intervals. The acid-cracking plant used a great deal of steam for the operation of the filter presses, and the cost of steam is considerably greater than electricity for power. The mill generates its own electric current considerably cheaper than it could be bought. The present method of utilizing exhaust steam from the last stage of the turbine as a source of heat for the raw waste prior to subsidence realizes no small saving, as the steam from this source has already furnished about 60 per cent of its energy to the turbine.

The present plant is therefore more economical to operate than the original, acid-cracking type, plant. It must be admitted, however, that the necessity of economical operation has transformed the original plant from a wastes-purification plant, in the fullest meaning of the term, to a grease-recovery plant, the original plant having as its purpose the production of a non-obnoxious effluent, while in the case of the present plant the original purpose has been modified to that of producing an effluent which will not cause objectionable conditions in the stream, at as low a cost as possible. The acid-cracking process removed about 90 per cent of the fats in the waste, while the centrifugal separators remove on the average 50 per cent.

The fact that the effluent from the centrifugal separators is at present discharged into the river without further treatment raises the question, "Could not this effluent be further purified?" The experience with the filter beds of the original plant indicated that it was possible to obtain an effluent of good appearance, that is, free of suspended matter, but that the grease which was not removed by the process of acid-cracking was little affected by filtration. Many experiments were run to determine a suitable filtering medium, but the expense of keeping any type of filter bed in operation was excessive. Obviously a greasy waste clogs a filter very rapidly.

The effluent discharged from the centrifugal separators increases the grease content of the Assabet River from an average of 20 p.p.m. to an average of 87 parts. These figures are based on analyses made from 1920 to 1924.

The trend of development of this plant has thus been along the lines of constant elimination of expense through the substitution of machines for labor and the elimination of chemicals, at the same time producing an effluent of reasonably low grease and solids content.

OF GENERAL INTEREST

"LOOP" HIGHWAY REPORT SUBMITTED

Special Commission Recommends Construction of Intermediate Thoroughfare at Estimated Net Cost of $22,000,000. Proposes Gasoline Tax and New Parking Regulations

The Special Commission to Investigate Boston Intermediate Thoroughfare has submitted its final report to the Legislature urging the construction of a "loop" highway from the Boston end of the Charles River Dam to the junction of Albany Street and Broadway, at an estimated net cost, after the deduction of betterments, of $22,000,000. The recommendations of the special commission are as follows:

Recommendations

"(*a*) The construction as a part of a complete city highway plan of the Intermediate Thoroughfare on the route indicated at an estimated gross cost of $27,800,000, and at an estimated net cost, after the deduction of betterments of $22,000,000. The Thoroughfare is a part of a carefully worked out general plan for street improvements in the down-town section and rectifies a fundamental error in the street plan of the city. It is in our opinion well worth its cost.

"(*b*) That the work be done by a special commission consisting of the three street commissioners and two appointees of the Governor, with a proviso that no taking or purchase of real estate or settlement of damages shall be made in excess of one and one-quarter times the assessed value of the property taken, except by a vote of four of the five members of the commission.

"(*c*) That bonds issued for the construction of the highway be liquidated in part by the collection of betterments assessed over as wide an area as possible, and in part by a gasoline tax, any balance coming from the general treasury of the city. If, however, the Legislature in its wisdom does not approve of the gasoline tax, we would still recommend the construction of the thoroughfare.

"(*d*) A ticketing law to assist the police in clearing the streets of parked automobiles where parking is forbidden, also the absolute prohibition of parking on the new thoroughfare."

The special commission consisted of Henry I. Harriman, *chairman*, chairman, Division of Metropolitan Planning; Frederic H. Fay, chairman, Boston City Planning Board; Charles L. Carr, chairman, Boston Finance Commission; Thomas F. Sullivan, chairman, Transit Department, City of Boston; and Thomas J. Hurley, chairman, Board of Street Commissioners, City of Boston. The above recommendations were subscribed to by the members of the commission except Mr. Carr, who dissented from the report of the majority in its recommendation in favor of the construction of the Intermediate Thoroughfare.

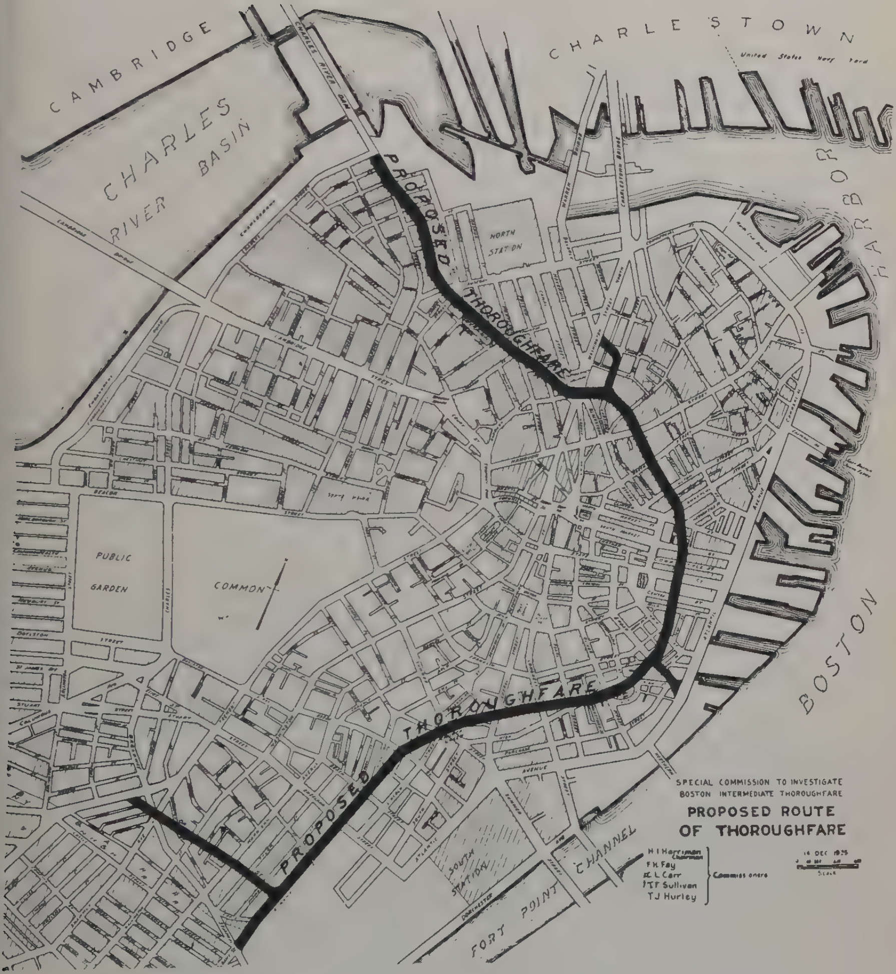

Fig. 1.—Proposed "Loop" Highway

History of Project

The so-called "loop" highway was originally suggested by the Boston City Planning Board, and the Legislature of 1924 created a special commission to study the scheme. This commission reported its conclusions the next year, and the Legislature adopted its recommendation for the construction of improvements at Dock Square, but referred the matter of the Intermediate Thoroughfare back for further study. The final report of the special commission has now been submitted to the Legislature, with its principal recommendations as quoted above, and this important proposition will be under consideration on Beacon Hill during the session which has just opened.

Chapter 32 of the Acts of 1925 not only referred back to the special commission the subject of the Intermediate Thoroughfare, but also broadened the scope of the investigation to include:

Scope of Investigation

"A. The Intermediate Thoroughfare itself.

"B. A comprehensive layout for street improvements in and leading to the down-town section of the City.

"C. The order in which any suggested street improvements should be carried out.

"D. Whether any of the crossings of main thoroughfares should be by means of vehicular subways or viaducts.

"E. The future construction under said Intermediate Thoroughfare of freight or passenger subways connecting the north and south sides of the business district.

"F. The general subject of traffic regulation and parking of vehicles in the city.

"G. The method of financing and carrying out any work recommended."

After a brief review of traffic conditions in Boston streets and an outline of the steps already taken for improving those conditions, such as authorizing the laying out of Stuart Street and the widening of Kneeland Street, Broadway, Tremont Street and Charles Street, Cambridge and Court streets, and the Dock Square widenings, the commission considers the possible remedies as follows:

Remedial Measures

"Several remedies have been suggested for the present intolerable conditions in the down-town section of Boston, to wit:

"A. To let conditions remain as they are and finally become so bad that business will tend to move out of the down-town section;

"B. To greatly restrict or entirely prohibit parking below Charles Street; or

"C. To rectify the fundamental error in Boston's street layout by constructing the Intermediate Thoroughfare.

"The first remedy we dismiss as too drastic. Neither morally nor legally is the death penalty recognized as the proper cure for old age.

"The second remedy seems to us for reasons which we will discuss later as entirely inadequate. A remedy which is entirely effective for a head cold is not a proper cure of pneumonia.

"Accordingly we recommend the construction of a loop highway which will run from the Boston end of the dam to Merrimac Street, thence along the line of Merrimac Street to Haymarket Square, thence along the general line of Cross Street to Commercial Street, thence approximately parallel to Atlantic Avenue to Fort Hill Square, crossing State Street approximately 400 feet from Atlantic Avenue, thence partly by public streets and partly over private property via Church Green, the square at the intersection of Summer and Bedford streets, to the corner of Albany Street and Kneeland Street, thence along Albany Street to Broadway with provision for a suitable connection from Albany Street to Tremont Street in the vicinity of the junction of Tremont Street and Shawmut Avenue.

"We also recommend the construction of a short branch from the Intermediate Thoroughfare along the lines of Endicott Street and Cooper Street to Washington Street, thus lessening the congestion in Haymarket Square and giving direct access through Washington Street and Beverly Street to the Charlestown and Warren bridges. We also recommend a slight widening of Broad Street between the Intermediate Thoroughfare and Atlantic Avenue.

"In this report, we do not recommend the construction of any vehicular subways, but we have studied the construction of such subways under two sections of the route —

"(*a*) From Fort Hill Square to Beach Street to avoid the congested intersections of Congress, Federal, Summer and Essex streets; and

"(*b*) Through the market district and under Haymarket Square to avoid the congestion in those two sections. We believe that in the near future such vehicular subways will be of the greatest possible value to the city and will not be unduly expensive.

"The Legislature not only directed this commission to study the Intermediate Thoroughfare, but also directed it to prepare a general street layout for the down-town section. We discuss this subject at length in the Appendix to this report, and we here only state that in our opinion the suggested layout for the Intermediate Thoroughfare fits in with a suitable comprehensive street layout of the city.

"Our layout calls in general for a new thoroughfare not less than 92 feet in width. This will provide adequate sidewalks and allow for eight lines of vehicles.

"Such a loop highway will give direct connection between the North and South stations, will connect with each other the freight yards of the three railroad systems entering the city, will tie together the market district, the piers and the railroads, and will give general traffic relief in the down-town district.

"In our opinion it will also be feasible, after the thoroughfare has been constructed, to prohibit through trucking on certain streets like Washington Street, Congress Street and Exchange Street, diverting such trucking to the loop highway and thus affording great relief and benefit to the retail and financial districts."

The length of the proposed thoroughfare, including the short extensions mentioned above, which are shown on the accompanying map, is 13,200 feet. The estimate gross cost is $27,837,000, of which land damages amount to $26,427,000 and construction cost is taken at $1,410,000. Although detailed figures are not given, the special commission has been advised by real estate experts that betterments can probably be assessed to the extent of about $6,000,000, thus making the estimated net cost under $22,000,000.

It is recommended that a special commission consisting of the three Street Commissioners of the city of Boston, together with two members to be appointed by the Governor, be entrusted with the layout of the street and the taking of the property, and that the Public Works Department of the city of Boston be delegated to take charge of the actual construction.

Gasoline Tax

In connection with the financing of the program it is recommended that a 2-cent gasoline tax be levied throughout the state, for the benefit of the cities and towns in which it is collected, and in the city of Boston for the payment of interest and payments of principal on the thirty-year serial bonds recommended in the report.

Traffic Regulation and Parking

As a result of its study of traffic regulation the commission recommends —

(*a*) That parking restrictions take the form of permanent prohibition of parking on one or both sides of streets rather than the limiting of parking to short periods.

(*b*) That curbing where parking is

definitely prohibited be marked with yellow or other distinctive color.

(*c*) That legislation be enacted permitting the police to ticket cars for offences such as parking, so that the person whose car is ticketed may have the choice of having the complaint settled for a minimum sum to be paid at police headquarters, or having the case tried in court in the ordinary manner.

(*d*) Improvement of conditions on Atlantic Avenue, particularly through the elimination of storage of cars thereon by the Union Freight Railroad.

(*e*) Prohibition of parking between 9 A.M. and 6 P.M. along the new Intermediate Thoroughfare.

(*f*) That encouragement be given to the building of garages on the outskirts of the down-town districts and at Boston Elevated Railway terminals, and the establishment of bus lines to enable persons leaving their cars at the outskirts of the business district to enter the main city by bus.

With the report of the special commission is submitted an Appendix giving a comprehensive layout for street improvements in and leading to the downtown section of the city.

Three legislative bills accompany the report: (1) An act authorizing the city of Boston to lay out and construct an Intermediate thoroughfare and to establish a major highway improvement fund; (2) gasoline excise highway tax; and (3) an act relative to the violation of parking regulations by motor vehicles.

Engineers Invited to Attend Lectures on Concrete

The Portland Cement Association is planning to repeat the set of six lectures, which it gave recently, on "The Design and Control of Concrete Mixtures." These will be held at the Massachusetts Institute of Technology, and will probably begin early in March. They are given once a week in the evening.

Engineers in this vicinity are invited to attend these talks which contain the most up-to-date information on concrete — design and practice.

The following brief synopsis explains their scope: (1) methods of securing density in concrete, effect of gradation of aggregate and the bulking of sand; (2) cleanness of sand, crushed stone *versus* gravel for producing dense concrete; (3) sieve analyses of sand and stone; (4) calculation of scientific mixes on bases of sieve analyses; (5) effect of water on strength and workability of concrete; and (6) twenty-eight day tests of cylinders made according to the designs calculated in the previous lectures.

Those desiring to enroll for the course should apply *promptly* (as only about 200 can be accommodated) to the Portland Cement Association, 10 High Street, Boston. There is no charge or expense to those attending these lectures.

Industrial Fuel and Power Sessions Well Attended

Much interest was shown in the recent two-day "Fuel and Power" meetings of the Affiliated Technical Societies of Boston. The December meeting of the Boston Society of Civil Engineers was omitted by vote of the Society on account of the Affiliation program for that month.

The day sessions on December 10 and 11, devoted to "Industrial Fuel and Power," included ten papers covering "Sources and Utilization of Fuels," "Requirements of Power in the Industries," "Operating Practice," and "Industrial Power." The total attendance at these meetings was more than a thousand.

The concluding event was a dinner at the new Chamber of Commerce building, attended by over three hundred. Following the dinner and entertainment, two addresses were given on the subject of Household Heating, one by Eugene C. Hultman, chairman of the Special Commission on the Necessaries of Life, Commonwealth of Massachusetts, and the other by Homer R. Linn of the American Radiator Company of Chicago.

Mr. Hultman's talk on "The Coal Situation" is of such timely interest that it is printed in full in this issue of the JOURNAL.

Arrangements are being made to print the ten papers on "Industrial Fuel and Power" in one volume, together with the discussion. A complete announcement as to this will probably appear in the February BULLETIN of the Affiliated Technical Societies of Boston.

Earthquake-Proof Construction

Two interesting pamphlets dealing with the essentials of earthquake-proof construction have recently been published by the Portland Cement Association. These give the results of investigations made by Prof. Arthur C. Alvarez of the engineering department of the University of California, following the Santa Barbara earthquake of June 29, 1925; and of H. M. Hadley of the Portland Cement Association, who reported upon the Tokyo–Yokohama earthquake of September 1, 1923, and on the Santa Barbara catastrophe.

These papers are devoted primarily to the question of the effects of earthquakes on buildings of various types, and to a discussion of the designs best suited to structures in those zones where it is most probable that serious earthquakes will take place. The Portland Cement Association, 10 High Street, Boston, will be glad to furnish copies of these publications on request.

The complete report by Professor Alvarez appears in the University of California Publications in Engineering, Vol. 2, No. 6, Nov. 17, 1925.

PROCEEDINGS OF THE SOCIETY

MINUTES OF MEETINGS

DESIGNERS SECTION

DECEMBER 9, 1925. — The regular December meeting of the Designers Section of the Boston Society of Civil Engineers was called to order at 6.05 P.M. in the Affiliation Rooms.

The minutes of the October and November meetings were read and approved.

The Chairman introduced Mr. C. Howard Walker of Walker-Walker and Kingsbury who spoke on "Fundamentals of Mass, Form and Proportion." At the close of an interesting talk a rising vote of thanks was given to Mr. Walker. There were 48 members and visitors present. The meeting was adjourned at 7.30 P.M.

SCOTT KEITH, *Clerk*.

SANITARY SECTION

OCTOBER 7, 1925. — The regular meeting of the Sanitary Section was held in the Library of the Affiliated Technical Societies on Wednesday, October 7, 1925.

Preceding the meeting 23 members of the Section met at Marston's Dining Room for dinner.

The meeting was called to order by the chairman at 7.30 P. M.

The minutes of the annual meeting held March 4, 1925, were read and approved.

The chairman then introduced Mr. Almon L. Fales, of Metcalf & Eddy, who gave a talk upon "Some Observations upon Sewage Treatment in England and Germany." The talk, which was extremely interesting, was illustrated by fifty lantern slides.

Messrs. H. P. Eddy, Jr., and Gordon Fair also spoke regarding their impressions of sewage works visited abroad. Others taking part in the discussion were Messrs. Dixon, Dorr, Holmes, Horne and Weston.

The meeting was well attended, there being 57 present.

Adjourned at 9.15 P. M.

R. W. HORNE, *Clerk.*

DECEMBER 2, 1925. — A regular meeting of the Sanitary Section was held in the Library of the Affiliated Technical Societies on Wednesday, December 2, 1925.

Preceding the meeting 14 members of the Section met at Marston's Dining Room for dinner.

The meeting was called to order by the chairman at 7.15 P.M., and the minutes of the meeting held October 7, 1925, were read and approved.

It was duly voted to amend the By-Laws of the Section so that Article VI, Section 3, would read: "The regular meetings of the Section shall be held on the first Wednesday of the months of March, June, October and December unless otherwise authorized by the Executive Committee." The chairman announced the coming dinner of the Affiliated Technical Societies and urged all who could to attend.

Mr. Dana M. Wood, chairman of the Committee on Garbage Disposal, presented a brief progress report, outlining the scope of the work which the committee is doing and explaining the questionnaire which is being sent to public officials.

Mr. Chase, chairman of the Section, then introduced Mr. Stuart E. Coburn, chemist with Metcalf & Eddy, who read a paper dealing with the "Relation of Hydrogen-ion Control in the Chemical Treatment of Tannery Waste." Mr. George G. Bogren, sanitary engineer with Weston & Sampson, was then introduced and read a paper regarding the "Development of the Recovery of Grease from Wool Scouring Liquors." The papers brought forth considerable discussion. Those taking part in the discussion were Messrs. Eddy, Fair, Dorr, Tyler, Porter, Gammage, Baity and Gibbons.

There were 28 present at the meeting.

Adjourned at 8.45 P.M.

R. W. HORNE, *Clerk.*

JANUARY 6, 1926. — A regular meeting of the Sanitary Section was held in the Library of the Affiliated Technical Societies on Wednesday, January 6, 1926.

Preceding the meeting 37 members of the Section met at Marston's Dining Room for dinner.

The meeting was called to order by the chairman at 7.15 P.M., and the minutes of the meeting held December 2, 1925, were read and approved.

Before introducing the speaker of the evening, the chairman called upon Mr. Desmond FitzGerald, who spoke briefly regarding some recent discoveries of the methods employed by the ancient Egyptians in quarrying large stones for various construction purposes.

Mr. W. L. Stevenson, chief engineer of the Pennsylvania Department of Health, and Secretary of the Pennsylvania Sanitary Water Board, was then introduced. Mr. Stevenson spoke on "The Sanitary Conservation and Utilization of Water Resources." He told in a very instructive manner of the steps which are being taken by the State of Pennyslvania to conserve water resources and to assist both municipalities and private interests to find a suitable means of disposing of their sewage and wastes. At the close of his talk Mr. Stevenson was given a vote of thanks in appreciation of his courtesy in coming to address the Section.

Those taking part in the discussion which followed the talk were Messrs. Chase, Dixon, Gammage, Hale, Kingsbury, Marston, Weston and Tyler. There were 57 present at the meeting.

Adjourned at 8.50 P.M.

R. W. HORNE, *Clerk.*

APPLICATIONS FOR MEMBERSHIP

[February 15, 1926]

The By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of twenty (20) days from the date given.

For Admission

Abrams, Julius, Malden, Mass. (Age 23, b. Vilna, Russia.) Graduate of Northeastern University, June, 1925, with B.C.E. degree. Now employed as assistant engineer by Farnham & Gleason, Inc., Civil Engineers, Wellesley, Mass. Refers to H. B. Alvord, W. E. Nightingale, C. T. Platter, David Shapiro, H. I. Wyner.

Bailey, Walter Clarence, Lynn, Mass. (Age, 24, b. Cambridge, Me.) Student at Northeastern University; has been employed during work periods by Aspinwall & Lincoln, and by Mass. Highway Division. Refers to H. B. Alvord, C. S. Ell, J. W. Ingalls, W. E. Nightingale.

Cheney, Frank L., Medfield, Mass. (Age 19, b. Westwood, Mass.) Employed by J. J. Van Valkenburg from April to August, 1924; with James Luchini from June to August, 1925; with Charles H. Gannett in August,1925. Entered Northeastern University in September, 1923, and during work periods is still employed by C. H. Gannett. Refers to H. B. Alvord, C. S. Ell, C. H. Gannett, J. W. Ingalls, W. E. Nightingale.

Classon, Walter Guy, Leominster, Mass. (Age 52, b. Fitchburg, Mass.) Educated in the public schools of Fitchburg. Was employed for eight years by W. K. Bailey, C.E., and then entered into partnership with same under firm name of Bailey & Classon, doing general surveying and engineering work. Employed by the Leominster Water Works as engineer from 1909 to 1913; later was employed by the Fitchburg Water Works and Sewerage Commission from 1914–17; October, 1918, appointed superintendent and registrar of the Leominster Water Works, which position he still holds. Refers to H. B. Allen, D. A. Hartwell, C. W. Sherman, A. D. Weston.

Gallagher, George Thomas, Dorchester, Mass. (Age 27, b. Brighton, Mass.) Has completed three-year course in engineering. Has had one year designing and detailing; two years in the field. At present construction inspector for city of Boston. Refers to G. D. Ballou, M. J. Caddigan, W. W. Clifford, Hyman Felderman, J. J. Harty, E. D. Mortenson.

Luchini, James, Milford, Mass. (Age 35, b. Milford, Mass.) Graduate of Harvard in 1914 with degree B.S. Has been assistant instructor in Harvard Engineering Camp; engineer and contractor to 1917; in the army until August, 1919; and general contractor to date, now on construction, park system, St. Petersburg, Fla. Refers to H. P. Eddy, Jr., E. A. Graustein, L. M. Hersum, L. J. Johnson, F. A. Marston.

Weaver, Frederic Nixon, West Somerville, Mass. (Age 36, b. Boston, Mass.) Graduate of Tufts College 1913, with degree of B.S. in civil engineering, September 1913, to September, 1915, New Eng. Structural Co.; September, 1915, to June, 1917, instructor in mathematics and English at Passaic High School; August, 1917, to July, 1919, with 101st Engineers; September, 1919, to date, three years instructor in mathematics and civil engineering and three years as assistant professor in civil engineering, teaching steel and concrete structures at Tufts College. Refers to Robinson Abbott, H. P. Burden, E. H. Cameron, W. D. Henderson, H. B. Perry.

WOODHALL, JAMES W., Cambridge, Mass. (Age 46, b. Sydney, Australia.) Graduate of Borough Polytechnic School of Engineering in London, Eng. Has been assistant resident engineer, Cairo, Egypt; asst. resident engineer for sewage disposal at Brussels, Belgium; superintendent of construction for P. Lyall & Sons, Montreal, on hotels, school and parliament buildings, public library, pulp and paper mills in various parts of Canada; during the war with Canadian engineers in France; is now superintendent of construction for M. Shapiro & Son, of New York. Refers to H. S. Cleverdon, A. E. Kendrew, E. A. Varney.

For Transfer from Junior

BOGREN, GEORGE GUSTAVE, Cochituate, Mass. (Age, 25, b. Cochituate, Mass.) Graduate of Harvard Engineering School in 1922 with degree of S.B. in sanitary chemistry. From 1922–23, assistant engineer, State Department of Public Health; from 1923 to date assistant sanitary engineer with Weston & Sampson. Refers to G. M. Fair, G. A. Sampson, R. S. Weston, Edward Wright.

CHIESA, OVIDIO D., Quincy, Mass. (Age, 25, b. Quincy, Mass.) Graduate of Quincy High School, and completed a five-year course at Franklin Union and received a certificate in structures and surveying. Entered the employ of the A. L. Smith Iron Works, Chelsea, in 1917 as a blue-print boy; has worked through detailing, designing, into the estimating department. In March, 1924, he was elected to the board of directors and is now outlining sales and estimating policies, etc. Refers to E. P. Adams, W. W. Clifford, H. A. Gray, B. E. Sullivan, A. L. Wannlund, A. O. Wilson.

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BOOK REVIEW

"Practical Accounting for the General Contractor," by H. D. Grant. Second Edition, 1925. McGraw-Hill Book Company, New York.

A book of 330 pages "containing a description of the system, to which is added a discussion of the methods and accounting practice that have become the standard practice in those contracting businesses where adequate records are kept."

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FOUNDED 1848

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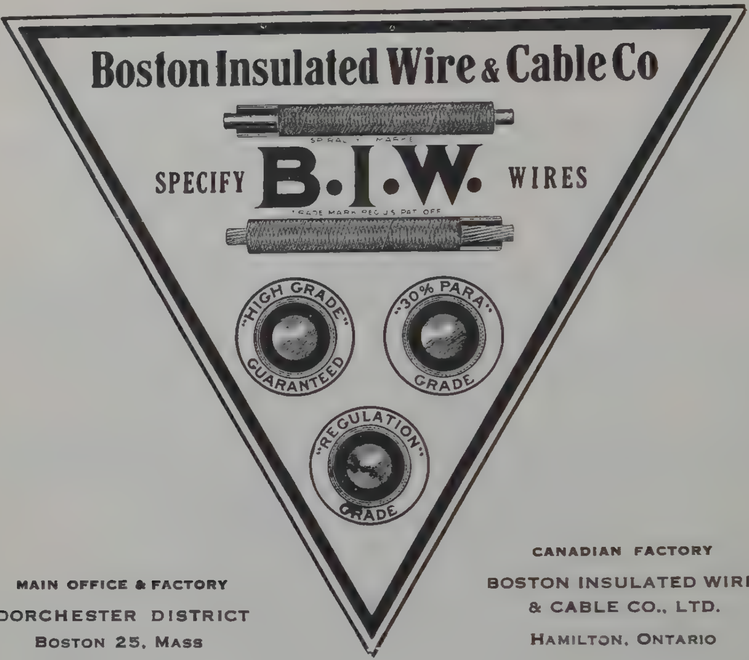

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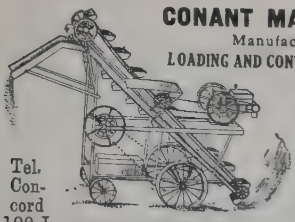

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Louisiana Engineering Society, State Museum Building, Jackson Square, New Orleans, La.

Montana Society of Engineers, Butte, Mont.

Pacific Northwest Society of Engineers, 803 Central Building, Seattle, Washington.

Rochester Engineering Society, 131–135 Sibley Building, Rochester, N. Y.

Technology Club of Syracuse, Vinney Building, Syracuse, N. Y.

Vermont Society of Engineers, Montpelier, Vt.

Western Society of Engineers, 1735 Monadnock Block, Chicago, Ill.

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